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Naoki Shibata

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EXAMINER

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ART UNIT

PAPER NUMBER

2811

DATE MAILED: 12/03/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/885,046

Applicant(s)

SHIBATA ET AL.

Examiner

Shouxiang Hu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 17 September 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-7 and 32-44 is/are pending in the application.
- 4a) Of the above claim(s) 35,36,38,43 and 44 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7,32-34,37 and 39-42 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

## DETAILED ACTION

### *Election/Restrictions*

1. First, the examiner would like to thank Attorney Peter A. Balnave for his timely reply to clarify applicant's indented election of species. During a telephone interview on November 26, 2003, attorney Balnave confirmed that applicant indeed intended to elect Species II and/or III for prosecution, instead of Species I as stated in the 2-12-02 election. **Reconfirmation of the species election should be made for the record by applicant in replying to this Office action.**

The instant invention as originally presented in claims 1-7 recites the subject matters of "an undercoat layer formed on said substrate and having a surface with convex portions each shaped like a truncated hexagonal pyramid", as directly recited in original claim 1. As stated in Office action of Paper No. 4, Species I of Fig. 5 which requires a growth suppressing material layer is substantially distinctive from both Species II of Fig. 7 and Species III of Fig. 9 which both require a Mg-doped GaN undercoat layer. And, according to the specification (see page 14, line 18 through page 15, line 7; and, page 31, line 4 through page 34, line 14), such recited convex portions each shaped like a truncated hexagonal pyramid are only formed in Species 2 of Fig. 7 and Species II of Fig. 9, but are unreadable on Species I of Fig. 5, as explained in the previous Office action in Paper No. 6. The fact that the applicant continuously elected claims that recite subject matters of a Mg-doped GaN under coat layer, such as in

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claims 2-4 in the latest amendment filed on 9-17-03, further confirms applicant's intention to elect the invention of Specie II and/or III

Since applicant has received an action on the merits for the originally presented invention, this invention has been constructively elected by original presentation for prosecution on the merits. Accordingly, claims unreadable on Species II and/or III are withdrawn from consideration as being directed to a non-elected invention in this Office action. See 37 CFR 1.142(b) and MPEP § 821.03.

More specifically, Newly submitted claims 35, 36, 38 and 43-44 are directed to inventions that are distinct from the invention of Species II and/or III as originally claimed and intendedly elected, as they are each unreadable on either Species II of Fig. 7 or Species III of Fig. 9.

Accordingly, claims 1-7 and 32-44 are pending in this application; and claims 1-7, 32-34, 37 and 39-42 remain active in this Office action.

### ***Claim Objections***

2. Claims 1-7, 37 and 39-42, insofar as being supported by applicant's elected species (Species II and/or III), are objected to because of the following informalities and/or defects:

In claim 1, the term of "is covered with" should read as: --has--

In claim 39, lines 4 and 5, the term of "layer in a plane projection" should read as: --layer--. In addition, claim 39 recites the subject matter that the width of the slop when projected to a flat plane is smaller than 2 um; but a clear and sufficient support for it is

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not found from the original disclosure for either Species II of Fig. 7 or Species III of Fig. 9, and applicant fails to point out where such support can be found.

Claims 37, 40, and 42 are further objected to as they each recite (although in an alternative manner) some limitations that are unreadable on the elected species — Species II of Fig. 7 or Species III of Fig. 9—.

In claim 40 and 41, the term of “percentage of area” should read as: --percentage area, when projected on plane of said undercoat layer--.

Appropriate correction is required.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-7, 32-34, 37 and 39-42, insofar as being supported by applicant's elected species (Species II and/or III), are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 1, 32, 34 and 39 each recite the subject matter that the recited undercoat layer is uniformed formed on the substrate. However, according to the original specification (page 32, lines 9-14), the undercoat layer in either Species II of Fig. 7 or Species III of Fig. 9 is formed through

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the formation of Mg cores, which makes the composition non-uniform during the formation of the undercoat layer.

***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 5, 32-34, 37 and 39-41, insofar as being in compliance with 35 U.S.C. 112 and as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 102(b) as being anticipated by Sunakawa et al. ("Sunakawa"; Japan 10-312971; of record).

Sunakawa discloses a Group-III nitride compound semiconductor device (Figs. 1, 3 and 6, especially Fig. 3; also see the English translation regarding Figs. 5 and 7 in US Patent 6,348,096, which is based on Japan 10-312971), comprising: a substrate (21); an undercoat layer (GaN; including layer 22 and a lower portion of layer 25; see Fig. 3(a)); and group-III semiconductor layers (including an upper portion of layer 25, and layers 66-68 and 70-73) overlying the undercoat layer; wherein the undercoat layer having a surface with convex portions each shaped substantially like a truncated hexagonal pyramid (see Figs. 3(a)-3(c)).

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Regarding claim 5, the substrate in Sunakawa can be  $\text{Al}_2\text{O}_3$  (which is often a synonym of sapphire in the art) or SiC (see Sections 0036 and 0085; or see col.5, lines 16-22 in US Patent 6,348,096).

Regarding claim 7, the GaN layers in Sunakawa have a function of a light-emitting device.

Regarding claim 34, insofar as being in compliance with 35 U.S.C. 112, the limitation of "formed continuously and unbrokenly" is a process limitation, and such limitation would not carry patentable weight in this claim drawing to a structure, because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claims 39-41, as being best understood in view of the claim objections above, the width of the slop of the convex portions in Sunakawa when projected to a flat plane can be naturally smaller than 2  $\mu\text{m}$ , as the whole size of the convex pattern can be as small as 0.1  $\mu\text{m}$  (see col. 3, lines 20-23, in US 6,348,096); and the percentage of the sloped area of the convex portions, when projected on plane of the undercoat layer, can be naturally within 30% to 70% (see Fig. 3 in Japan 10-312971).

### ***Claim Rejections - 35 USC § 103***

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2, 3, 6 and 42, insofar as being in compliance with 35 U.S.C. 112 and as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 103(a) as being unpatentable over Sunakawa et al. ("Sunakawa"; 10-312971) in view of Kern et al. ("Kern"; 6,194,742).

The disclosure of Sunakawa is discussed as applied to claims 1, 5, 32-34, 37 and 39-41 above.

Sunakawa does not disclose that the GaN undercoat layer can be doped with Mg. However, Kern teaches to form a GaN-base light-emitting device (Fig. 3; also see col. 3, lines 6-22, and lines 66-67), comprising a Mg-doped GaN undercoat layer (16), for increasing device reliability and reproducibility.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the semiconductor device of Sunakawa with the undercoat layer being doped with Mg, so that a semiconductor light-emitting device with increased device reliability and reproducibility would be achieved, per the teachings of Kern.

Regarding claim 3, the Mg concentration in the undercoat layer in Kern can be up to  $5 \times 10^{21} \text{ cm}^{-3}$  (see col. 4, line 52-53).

Regarding claims 6 and 42, although Sunakawa does not expressly disclose that the device can further comprise a sedimentary layer between the substrate and the undercoat layer, Kern further teaches to include such a sedimentary layer (14; a buffer layer made of AlN, GaN or AlGaIn, see col. 1, lines 49-63)) in the GaN-based light-emitting device. It would therefore have been obvious to one of ordinary skill in the art



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at the time the invention was made to further incorporate the sedimentary layer of Kern into the device of Sunakawa for improving the quality of the epitaxially grown GaN layers.

### ***Allowable Subject Matter***

6. Claim 4 would be allowable if rewritten or amended to overcome the rejection(s) under 35 U.S.C. 112, first paragraph, and the claim objection(s) set forth in this Office action.

7. The following is a statement of reasons for the indication of allowable subject matter: Prior art does not teach or render obvious a Group-III nitride compound semiconductor device, comprising a Mg-doped GaN undercoat layer, wherein the undercoat layer having a surface with convex portions each shaped like a truncated hexagonal pyramid; and the undercoat layer is also doped with an n-type dopant and is of an n-type overall.

### ***Response to Arguments***

8. Applicant's arguments filed on July 29, 2002 have been fully considered but they are not persuasive.

Applicant's main arguments include: the applied prior art references do not teach the claimed invention of the instant application, because they each fail to disclose that the undercoat layer is uniformly formed on the substrate. The response to these arguments have been fully incorporated into the "112" claim rejections and the claim

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objections set forth above in this Office action, in view of the response to arguments in the last Office action.

### ***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

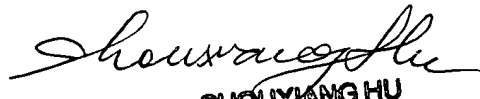
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is (703) 306-5729. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (703) 308-1690. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9318.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SH  
November 28, 2003

  
SHOUXIANG HU  
PRIMARY EXAMINER